MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

EME3056 – INDUSTRIAL MANAGEMENT

(ME)

8 OCTOBER 2015
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 9 pages with 5 questions.
2. Of the questions no. 1 & 2, choose and answer ONE of them.
3. Questions no. 3, 4 & 5 must be answered.
4. All questions carry equal marks and the distribution of the marks for each question is given.
5. Please write all your answers in the Answer Booklet provided.

Question 1 (25 marks)

There are two alternative plans for a palm oil refining project. The output is measured in liters. Let Q be the amount of liters of output. The details are as follows:

Details that are specific to Plan *A*	:	Labour costs traced to each liter, \$ 0.95 + 0.0015Q Transportation and handling costs traced to each liter, \$ 0.015 Overhead costs traced to each liter, \$ 1.90 Rejection rate of production, 2.0% Estimated liters produced per day, 320
Details that are specific to Plan *B*	:	Labour costs traced to each liter, \$ 0.7 Transportation and handling costs traced to each liter, \$ 0.025 Overhead costs traced to each liter, \$ 2.00 + 0.002Q Rejection rate of production, 3.0% Estimated liters produced per day, 380

Details that are common to both plans are:
Sales price of each liter is \$ 12.00.
Purchase costs of ingredients traced to each liter, \$ 3.90
Starting revenue R_o and starting costs C_o are both zero.

(a) Obtain the revenue per liter for plan *A*, dR_A/dQ. (Consider the rejection rate in the calculation.) [3 marks]

(b) Obtain the revenue per liter for plan *B*, dR_B/dQ. (Like in part (a), consider the rejection rate too.) [3 marks]

(c) Obtain the costs per liter in terms of Q for plan *A*, dC_A/dQ. [4 marks]

(d) Obtain the costs per liter in terms of Q for plan *B*, dC_B/dQ. [4 marks]

(e) Determine the output of liters $Q_{A,P}$ for optimal profit from plan *A*. Round **up** $Q_{A,P}$ to the nearest multiple of 320 and label this rounded value $Q_{A,P,R}$. [3 marks]

(f) Determine the output of liters $Q_{B,P}$ for optimal profit from plan *B*. Round **up** $Q_{B,P}$ to the nearest multiple of 380 and label this rounded value $Q_{B,P,R}$. [3 marks]

(g) Using $Q_{A,P,R}$, find the daily profit of plan *A*, $P_{A,daily}$. [6 marks]

(h) Using $Q_{B,P,R}$, find the daily profit of plan *B*, $P_{B,daily}$. [6 marks]

(i) Assume that either plan can be restarted (i.e. Q resets to zero) at the end of the day *after* optimal profit has been achieved. Also, assume that both plans are repeatable.
State the plan which is more profitable in the long term. [1 mark]

Continued...

Question 2 (25 marks)

Figure 1 shows the cash flow diagram for a project. The revenues are composed of periodic cash flows R_A and an additional single cash flow R_S at the end of the project. The expenses are composed of periodic cash flows E_A and an additional single cash flow E_0 at the start of the project.

(The periods on the revenue side of the diagram has been labeled "*1,R*", "*2,R*" and so on to differentiate it from periods on the expense side of the diagram, which, likewise, have been labeled "*1,E*", "*2,E*" and so on.)

The interest rate is the Minimum Attractive Rate of Return (MARR) of the project, ε, which is 6%. It is charged in synchronization with the time periods of the **revenue side** of the cash flow diagram.

The values of the cash flows are as follows:

R_A = \$950 R_S = \$1600 E_0 = \$2200 E_A = \$450

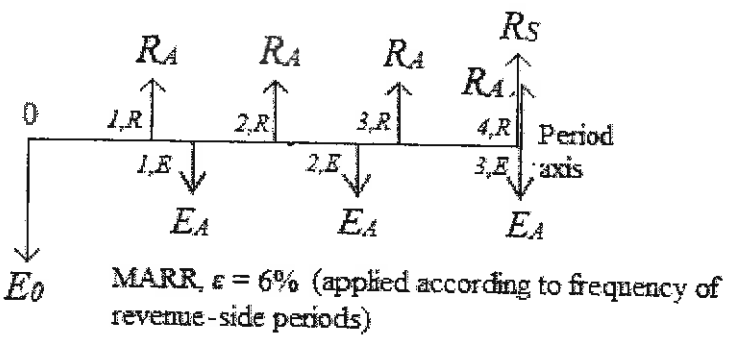

Figure 1

(a) The periods for the expense side of the diagram occur out of synchronization with the application of the interest rate MARR ε. Find the equivalent interest rate ε_j which is applied on the expense-side periods. [3 marks]

(b) Find the equivalent future worth of the revenues FW_R. [6 marks]

(c) Find the equivalent present worth of the expenses PW_E. [7 marks]

(d) Using the external rate of return method, find the external rate of return (*ERR*). [3 marks]

(e) Compare the *ERR* with the MARR and state whether the project is feasible or not. [1 mark]

Continued...

(f) The manager of the project would like to replace all the expense flows with a uniform gradient cash flow series in order to delay payment for expenses. The replacement expense flow series is subjected to the interest rate ε_j, as obtained in part (a), and has the same number of periods.

(i) Calculate the uniform gradient G for this cash flow series. [3 marks]

(ii) Find the cash flow at period 2,E in this cash flow series. [1 mark]

(iii)Find the cash flow at period 3,E in this cash flow series. [1 mark]

Question 3 (25 marks)

There is a public project to build a bridge in order to overcome traffic problems along a coastal region. There are two alternative plans for this public project.

- Plan #1 is to build a set of flyover bridges over land.
- Plan #2 is to build a set of bridges over coastal waters.

The interest rate for both plans is $i = 6\%$ per period*. The details of one plan are independent of the details of the other plan.

Table 1: Details of Plan #1 and Plan #2

No.	Detail Name	Plan #1	Plan #2
1	Estimated Construction Cost, I ($)	$ 4,500,000	$6,900,000
2	Estimated Losses due to Inconvenience Caused by Construction, E_0 ($)	$870,000	$450,000
3	Useful Life**, N (no. of periods)	4	3
4	Expected Operational Expenses per period, E_A ($)	$800,000	$1,000,000
5	Expected Benefits*** per period, B_A ($)	$2,920,000	$4,860,000

* Every period is four years in length. This note is mainly for the sake of believability of the question and is not expected to have a role in the solution.

** In this case, useful life is defined as the time during which the bridges are reliably safe. There is no salvage value for the bridges at the end of their useful lives.

*** The benefits include estimated savings in working hours and estimated fuel savings among the public which use the bridges.

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(a) Assuming uniform depreciation and taking the estimated construction cost I to be the initial book value BV_0 of the bridges, calculate the depreciation per period D_1 for plan #1. [1 mark]

(b) Repeat part (a) for plan #2. (Label the answer D_2.) [1 mark]

Assume that both plans are repeatable. Furthermore, assume that when the plans are repeated, the details as mentioned in Table 1 are repeated with no differences. Assume that there are no delays between repeats for either plan.

(c) Find the minimum number of times that each plan has to be run so that both of them achieve cotermination. [2 marks]

(d) Find the periodic costs $C_{A,1}$ of the plan #1, after it has been run the number of times as determined in part (c).
Assume that the contribution of the construction cost I and salvage value SV can be represented with depreciation per period D, as obtained in part (a). [6 marks]

(e) Repeat part (d) for plan #2. (Label the answer $C_{A,2}$.) [6 marks]

(f) Find the benefit-to-cost ratios for both plans #1 and #2. [3 marks]

(g) State the plan that is more beneficial to the public in the long-run. (Assume that inconsistent ranking is not an issue for this question.) [1 mark]

(h) Let there be a scenario where Plan #1 has been chosen for the project, independent of the results of part (g). In this scenario, there is a plan to upgrade the bridges in the end of the 1st period of their useful life.

The cost for the upgrade is \$980,000. The upgrade is expected to reduce the operational expenses to \$500,000 per period. The upgrade does not extend the useful life of the bridges. If the upgrade is performed, parts of the bridge are removed. These parts have a market value of \$400,000.

Using a study duration between the end of the 1st period and the end of the useful life of the bridges, obtain the EUC for keeping the bridges as they are and the EUC for upgrading them. [4 marks]

(i) Referring to part (h), state whether the upgrade is justified or not. (Assume that inconsistent ranking is not an issue for this question.) [1 mark]

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Question 4 (25 marks)

The following are examples of economic activity in the industrial and commercial sectors, with brief descriptions:

- Shipping: the transportation of goods
- Commuting: the providing of transportation for people so that they can travel from place to place
- Construction: the building of structures
- Retail: the selling of goods directly to the customer
- Mining: the removal of valuable ore from the earth

(a) Select just **one** economic activity from the list above, for the purpose of answering parts (b) to (i).
Alternatively, mention one economic activity which is not within this list. It must be engineering-related. [1 mark]

(b) Give a brief example of how the economic activity in part (a) can be planned. [3 marks]

(c) Briefly explain the benefit and/or importance of the example of planning in part (b) to the economic activity in part (a). [3 marks]

(d) Give a brief example of how the economic activity can be organized. [3 marks]

(e) Briefly explain the benefit and/or importance of the example of organization in part (d). [3 marks]

(f) Give a brief example of how the economic activity can be controlled. [3 marks]

(g) Briefly explain the benefit and/or importance of the example of controlling in part (f). [3 marks]

(h) Give a brief example of leading within the economic activity. [3 marks]

(i) Briefly explain the benefit and/or importance of the example of leadership in part (h). [3 marks]

Answers for parts (b) to (i) should be specifically applicable to the economic activity which has been selected and must not be applicable to the other activities, i.e. the answers must not be trivial or generalized.

(Refer to Appendix 1 for the meanings of the terms "economic activity", "engineering", "planning", "organizing", "controlling" and "leading" within the scope of this subject. The meanings are not to be directly used as answers.)

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Question 5

(a) Refer to Table 2 in Appendix 3. For **every** classical thought of management in the table, answer the following questions:

(i) Mention one brief example of how employees can be enabled (i.e. made capable of) to achieve performance goals in an organization which follows this thought of management. [6 marks]

(ii) Mention one brief example of how to improve the performance of under-performing employees in an organization which follows this thought of management. [6 marks]

(iii) Mention one brief example of how an employee who is to be disciplined can be corrected according to this thought of management. [6 marks]

(Any example which has been given should not be repeated.)

(b) Refer to Table 3 in Appendix 3 for the modern thoughts of management.

(i) Select **one** modern thought of management. *Alternatively*, select a thought of management which is not within the list; this must be a modern thought of management.
This selection will be used to answer the following parts (ii) and (iii). [1 mark]

(ii) Assume that this modern thought of management can complement (i.e. used to support and/or improve) the classical thoughts of management.
Select **one** classical thought of management, and mention an example of how the modern thought in part (i) complement the classical thought. [3 marks]

(iii) Assume that this modern thought of management has incompatibility (i.e. mismatching/clashing characteristic) with the classical thoughts of management.
Select **one** classical thought of management (it may be different from the one in part (ii)), and mention an example of an incompatibility with the modern thought in part (i). [3 marks]

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Appendix 1 - Glossary

The following terms are given definitions according to the scope of this subject and this exam paper. Terms appear in the order in which they appear in the previous pages.

Cotermination	:	The condition where the end of the timeline of one plan (repeated as necessary) matches the end of the timeline of another plan (repeated as necessary).
EUC	:	Equivalent Uniform Cost. This is the equivalent interest-adjusted periodic costs which include the contribution of the capital and opportunity costs of a plan, as well as its expenses.
Economic activity	:	Operations/Businesses which are carried out for the purpose of industry and/or commerce.
Engineering	:	The application of science and technology for the purpose of industry and/or commerce.
Planning	:	The act of setting objectives and determining what should be done to accomplish them.
Organizing	:	The process of collecting people and resources together to achieve a common purpose.
Controlling	:	The process of measuring performance and taking action to ensure desired results.
Leading	:	The act of arousing enthusiasm and inspiring effort in others to achieve goals and being proactive in making decisions to achieve goals.

Appendix 2 – Table of Factors/Multipliers for Time-Equivalent Money Values

$i = 6\%$			
N	$F/A, i\,\%, N$	$P/F, i\,\%, N$	$A/P, i\,\%, N$
1	1.0000	0.9434	1.0600
2	2.0600	0.8900	0.5454
3	3.1836	0.8396	0.3741
4	4.3746	0.7921	0.2886
5	5.6371	0.7473	0.2374
6	6.9753	0.7050	0.2034
7	8.3938	0.6651	0.1791
8	9.8975	0.6274	0.1610
9	11.4913	0.5919	0.1470
10	13.1808	0.5584	0.1359
11	14.9716	0.5268	0.1268
12	16.8699	0.4970	0.1193

*Note: Consider the value of N very carefully. The value of N to be used is not always straightforward.

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Appendix 3 – Brief Descriptions of Management Thoughts

The following terms are brief descriptions of several thoughts of management, arranged in categories of historical/classical and modern thoughts.

Table 2: Historical Thoughts of Management

Name	Brief Description
Frederick Taylor's Scientific Management	Workers should be taught and trained to perform their jobs efficiently. It also states that working conditions should be set such that they are conducive to the workers' performance. Workers should also be provided resources, support and tools to perform their job effectively.
Henri Fayol's Administrative Principles	An organization should have a clear and unbroken line of communication in the ranks of the organization (i.e. scalar chain). Every person in this organization should report to only one superior (i.e. unity of command). Activities with the same performance objective should be directed by one manager (i.e. unity of direction).
Max Weber's Bureaucratic Organization	A bureaucratic organization is a well-ordered and efficient form of organization. It has clear division of tasks, clear hierarchy of authority, formal rules and procedures. It offers careers based on merit.

Table 3: Modern Thoughts of Management

Name	Brief Description
Contingency Thinking	Contingency thinking is about having a plan to deal with emergencies or unexpected situations. It is about matching managerial responses with problems and opportunities due to different situations.
Organizations as Systems	An organization is a group of internal systems which work with each other to achieve the organization's goals. These internal systems share knowledge and coordinate with each other to achieve success. The organization also interacts with its environment (i.e. suppliers and customers) and work with them so as to become better at serving each other.
Knowledge Management	Knowledge management is the process of cultivating the skill and talent to use knowledge to improve the performance of an organization and to promote continuous learning of said knowledge.

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Appendix 4 - Equations

Equation for profit maximization theory

$$dR/dQ = dC/dQ$$

Equivalent interest rate for time periods j which are out of sync with interest rate i

$$i_j = (1+i)^{N/j} - 1$$

Future worth of periodic cash flows

$$FW = A\left(\frac{(1+i)^N - 1}{i}\right)$$

Present worth of periodic cash flows

$$PW = A\left(\frac{(1+i)^N - 1}{i(1+i)^N}\right)$$

Future worth of single cash flow

$$FW = P(1+i)^{N-k}$$

Present worth of single cash flow

$$PW = F(1+i)^{-k}$$

External rate of return

$$ERR = \left(\frac{FW_R}{PW_E}\right)^{\frac{1}{4}}$$

Present worth of a uniform gradient cash flow

$$PW = G\left(\frac{1}{i(1+i)^N}\left(\frac{(1+i)^N - 1}{i} - N\right)\right)$$

Cash flow at period k in a uniform gradient series

$$C_k = (N-1)G$$

Depreciation per period, with assumption of uniform depreciation and no salvage value

$$D = \left(\frac{BV_0}{N}\right)$$

Periodic worth of present cash flow

$$AW = P\left(\frac{i(1+i)^N}{(1+i)^N - 1}\right)$$

EUC of keeping an asset, assuming no salvage value

$$EUC = MV(A/P, i\%, N) + E_A$$

EUC of upgrading an asset, assuming no salvage value

$$EUC = I(A/P, i\%, N) + E_A$$

End of Paper